

NEBRASKA NATURAL RESOURCES COMMISSION

Water Sustainability Fund

Application for Funding

Section A.

ADMINISTRATIVE

PROJECT NAME: Secondary bedrock aquifer reconnaissance sampling in Eastern Nebraska

PRIMARY CONTACT INFORMATION

Entity Name: Lower Platte South Natural Resources District (NRD)

Contact Name: Katie Cameron

Address: 3125 Portia St, Lincoln NE 68521

Phone: 402-476-2729

Email: kcameron_enwra@lpsnrd.org

Partners / Co-sponsors, if any: ENWRA group (Lower Platte North NRD, Lower Platte South NRD, Lower Elkhorn NRD, Lewis and Clark NRD, Papio-Missouri River NRD, Nemaha NRD), US Geological Survey

1. Dollar amounts requested: (Grant, Loan, or Combination) Grant.

Grant amount requested. \$ 96,300

Loan amount requested. \$ 0.00

If Loan, how many years repayment period? [Click here to enter text.](#)

If Loan, supply a complete year-by-year repayment schedule.
[Click here to enter text.](#)

2. Permits Needed - Attach copy for each obtained (N/A = not applicable)

Nebraska Game & Parks Commission
(G&P) consultation on Threatened and

Endangered Species and their Habitat	N/A <input checked="" type="checkbox"/> Obtained: YES <input type="checkbox"/> NO <input type="checkbox"/>
Surface Water Right	N/A <input checked="" type="checkbox"/> Obtained: YES <input type="checkbox"/> NO <input type="checkbox"/>
USACE (e.g., 404 Permit)	N/A <input checked="" type="checkbox"/> Obtained: YES <input type="checkbox"/> NO <input type="checkbox"/>
Cultural Resources Evaluation	N/A <input checked="" type="checkbox"/> Obtained: YES <input type="checkbox"/> NO <input type="checkbox"/>
Other (provide explanation below) Click here to enter text.	N/A <input checked="" type="checkbox"/> Obtained: YES <input type="checkbox"/> NO <input type="checkbox"/>

3. Are you applying for funding for a combined sewer over-flow project?

YES ☐ NO ☒

If yes, do you have a Long Term Control Plan that is currently approved by the Nebraska Department of Environmental Quality?

YES ☐ NO ☒

If yes attach a copy to your application.

If yes what is the population served by your project?

If yes provide a demonstration of need.

If yes and you were approved for funding in the most recent funding cycle, then resubmit the above information updated annually but you need not complete the remainder of the application.

4. If you are or are representing an NRD, do you have an Integrated Management Plan in place, or have you initiated one?

N/A ☐ YES ☒ NO ☐

5. Has this application previously been submitted for funding assistance from the Water Sustainability Fund and not been funded?

YES ☐ NO ☒

If yes, have any changes been made to the application in comparison to the previously submitted application?

If yes, describe the changes that have been made since the last application.

No, I certify the application is a true and exact copy of the previously submitted and scored application. (Signature required)

6. Complete the following if your project has or will commence prior to next July 1st.

As of the date of submittal of this application, what is the Total Net Local Share of Expenses incurred for which you are asking cost share assistance from this fund? \$ 0.00

Attach all substantiating documentation such as invoices, cancelled checks etc. along with an itemized statement for these expenses. N/A

Estimate the Total Net Local Share of Expenses and a description of each you will incur between the date of submittal of this application and next July 1st for which you are asking cost share assistance from this fund.
\$ 0.00

Section B.

DNR DIRECTOR'S FINDINGS

Does your project include physical construction (defined as moving dirt, directing water, physically constructing something, or installing equipment)?

YES ☐ NO ☒

- 1(a). If yes (structural), submit a feasibility report (to comply with Title 261, CH 2) including engineering and technical data and the following information:

A discussion of the plan of development (004.01 A);

A description of all field investigations made to substantiate the feasibility report (004.01 B);

Maps, drawings, charts, tables, etc., used as a basis for the feasibility report (004.01 C);

A description of any necessary water and land rights and pertinent water supply and water quality information, if appropriate (004.01 D);

A discussion of each component of the final plan including, when applicable (004.01 E);

Required geologic investigation (004.01 E 1);

Required hydrologic data (004.01 E 2);

Design criteria for final design including, but not limited to, soil mechanics, hydraulic, hydrologic, structural, embankments and foundation criteria (004.01 E 3).

- 1(b). If no (non-structural), submit data necessary to establish technical feasibility including, but not limited to the following (004.02):

A discussion of the plan of development (004.02 A);

In eastern Nebraska, secondary bedrock aquifer systems are increasingly being considered to supplement growing municipal, domestic, commercial/industrial, and agricultural water demands. Within the Eastern Nebraska Water Resources Assessment (ENWRA) area, airborne geophysical (AEM) surveys have mapped the thickness and extent of these aquifers over much of eastern Nebraska; however little is known about the age and quality of water in the secondary systems. An improved

understanding of the extent and quality of the aquifer systems is important in determining how increased development of the resource could impact the water quality. Furthermore, a better understanding of the age of the resources will show where recharge is occurring, and where anthropogenic compounds could be introduced into the system. This study will focus on sampling existing wells (monitoring, domestic, or irrigation) for basic water chemistry, stable isotopes, age tracers, and anthropogenic compounds such as triazine. Wells will be selected by utilizing both the AEM surfaces and screen information provided by the Nebraska Department of Natural Resources (DNR) registered well database. Well selection will be focused in areas where wells in close proximity are screened at differing elevations within the secondary bedrock aquifers. The purpose of sampling multiple wells in close proximity is to better understand how the quality and age changes within the aquifer by depth.

A description of field or research investigations utilized to substantiate the project conception (004.02 B);

This study focuses on determining the water quality of the secondary aquifers, and if the quality is suitable for domestic and agricultural uses. Additionally, the samples will be used for age dating to determine the recharge rates. This information will be important to understand if the supplies could be impacted by anthropogenic contaminants. Previous studies focused on the secondary aquifer systems within Nebraska are limited, but include a 2001 paper by Gosselin and others (Appendix 1) which discusses the sources and quality of the Dakota suboutcrop area of Nebraska, but more wells have been drilled into the Dakota to the west of this paper's study area. Samples have been collected from the Dakota aquifer in the Papio-Missouri NRD as part of the NRD's groundwater management plan since 1992 (Verstraeten and Ellis, 1994; McGuire and others, 2012 - Appendix 1). The sampling plan for this proposed project is similar to the plan used in Verstraeten and Ellis (Appendix 1). The age tracers can be used to estimate recharge rates, based on work done by McMahon and others, 2011 (Appendix 1). All samples will be collected in accordance to US Geological Survey sampling standards, as defined in the US Geological Survey National Field Manual for the Collection of Water-Quality Data (US Geological Survey, variously dated - Appendix 1).

A description of the necessary water and/or land rights, if applicable (004.02 C)

N/A, permission to sample existing wells will be obtained through the individual NRDs.

A discussion of the anticipated effects, if any, of the project upon the development and/or operation of existing or envisioned structural measures including a brief description of any such measure (004.02 D).

This study will examine the water quality of the secondary bedrock aquifers throughout Eastern Nebraska. These findings will be related to consumptive water standards for the State of Nebraska, to determine if the water is suitable for human consumption and

agricultural production. These results could lead to municipal water supply development in areas where the quality and/or quantity of the primary aquifer has been adversely impacted by overdevelopment or contamination.

2. Provide evidence that there are no known means of accomplishing the same purpose or purposes more economically, by describing the next best alternative.

The other option would be to gather no data, which could lead to development of the secondary aquifer systems in areas where the resource is already impacted or not sustainable for long term municipal, domestic, commercial/industrial or agricultural use (see table in next item, Section B #3 for potential costs related to gathering no data).

3. Document all sources and report all costs and benefit data using current data, (commodity prices, recreation benefit prices, and wildlife prices as prescribed by the Director) using both dollar values and other units of measurement when appropriate (environmental, social, cultural, data improvement, etc.). The period of analysis for economic feasibility studies shall be fifty (50) years or with prior approval of the Director, up to one hundred (100) years [T261 CH 2 (005)].
 - Describe any relevant cost information including, but not limited to the engineering and inspection costs, capital construction costs, annual operation and maintenance costs, and replacement costs. Cost information shall also include the estimated construction period as well as the estimated project life (005.01).

Costs associated with the project are for research related activities (Section D #4 and cost/benefit table in this Section, Section B #3).

- Only primary tangible benefits may be counted in providing the monetary benefit information and shall be displayed by year for the project life. In a multi-purpose project, estimate benefits for each purpose, by year, for the life of the project. Describe any intangible or secondary benefits separately. In a case where there is no generally accepted method for calculation of primary tangible benefits describe how the project will increase water sustainability, such that the economic feasibility of the project can be approved by the Director and the Commission (005.02).

The life of this initial reconnaissance project is two years with groundwater sampling in the first year and USGS analysis and report generation into year two. The primary project benefit is the new information that could be used in a targeted manner for years following. Secondary benefits from the project could include installing more targeted water supplies where sustainable good quality water is more likely to be available below the primary aquifers. Targeted informed management could help prevent expensive

well installations that may yield non-sustainable or poor quality water supplies. Regarding municipal well costs (17 installed in ENWRA in last 2 years): they could be anywhere from \$200,000 to \$500,000 if you include the pump, wellhouse, controls and electrical depending on the end application (personal communication with Layne well drilling company in Valley, Nebraska 12/11/15). The domestic well installations (587 installed in ENWRA in last two years), typically range from \$18 to \$25 per foot (Matt Marxsen, state Conservation and Survey Division [CSD] driller and private well installer 12/11/15) for wells 50 to 350 feet deep (\$900-\$8,750). Irrigation wells (432 installed in ENWRA the last two years) are in the middle range with installations expected to be \$40,000 to \$80,000 in the secondary aquifers for eastern Nebraska (personal communication with representative of Grosch Irrigation Co., Inc. 12/18/15)

- All benefit and cost data shall be presented in a table form to indicate the annual cash flow for the life of the proposal, not to exceed 100 years (005.03).

Activity	Cost Year 1	Cost Year 2*	Cost TOTAL	Benefits (potential cost savings of siting 3 well types in unsuitable aquifers)
WSF Grant funding	\$96,300	0	\$96,300	Municipal well cost: \$200,000-\$500,000 Irrigation well cost: \$40,000-\$80,000 Domestic well cost: \$900-\$8,750
USGS	\$27,500	\$22,000	\$49,500	
ENWRA	\$34,200	\$30,000	\$64,200	
TOTALS			\$210,000	\$240,900-\$588,750

*Funding is only sought for one year through the Water Sustainability Fund. Funding will be carried over into year 2 to complete proposed activities.

- In the case of projects for which there is no generally accepted method for calculation of primary tangible benefits and if the project will increase water sustainability, the economic feasibility of such proposal shall be demonstrated by such method as the Director and the Commission deem appropriate (005.04).
4. Provide evidence that sufficient funds are available to complete the proposal.

ENWRA has allocated \$64,200 funds towards this proposal. The US Geological Survey has Cooperative Water Program fund dollars available for this project. Please see Appendix 4 for letters of support pledging the associated funding amounts (Table 2 of Appendix 3 lists ENWRA dues breakdown and tax levy information for each NRD and Table 3 of Appendix 3 depicts ENWRA's FY16 banked funds amount).

5. Provide evidence that sufficient annual revenue is available to repay the reimbursable costs and to cover OM&R (operate, maintain, and replace).

Please see Appendix 4 for letters of support, which describe funds available for the project (also Table 2 of Appendix 3 lists ENWRA dues breakdown and tax levy information for each NRD).

6. If a loan is involved, provide sufficient documentation to prove that the loan can be repaid during the repayment life of the proposal.

N/A

7. Describe how the plan of development minimizes impacts on the natural environment.

No construction is planned for this project. During sampling, waste produced and chemicals used for sample preservation and equipment cleaning will be disposed of in a safe manner, in accordance with the USGS Field Manual, Chapters A4 and A5 (Appendix 1).

8. Explain how you are qualified, responsible and legally capable of carrying out the project for which you are seeking funds.

Each NRD is charged with maintaining water quality and quantity for municipal, domestic, agricultural, and commercial/industrial uses. The NRD staff members bring local knowledge of the area and groundwater resources, and the USGS has the expertise in water quality sampling.

9. Explain how your project considers plans and programs of the state and resources development plans of the political subdivisions of the state.

The six NRDs in Eastern Nebraska, which make up the ENWRA group, are political subdivisions tasked with managing the groundwater resources for the region. This project is named as one of the projects in ENWRA's Long Range Plan (LRP) and ties to several of the LRP objectives (Appendix 3, Table 1). Gathering additional groundwater data and sustainability understandings support many state plans/programs (interagency coordination, integrated management, and prioritization of data collection and analysis capabilities to support state and local planning efforts outlined in DNR's annual report dated September 2015)

10. Are land rights necessary to complete your project?

YES ☐ NO ☒

If yes, provide a complete listing of all lands involved in the project.

If yes, attach proof of ownership for each easements, rights-of-way and fee title currently held.

If yes, provide assurance that you can hold or can acquire title to all lands not currently held.

11. Identify how you possess all necessary authority to undertake or participate in the project.

The participating NRDs have the authority under Nebraska State Statute Chapter 2 Article 32 to carry out this project under its authorized purposed relating to the development, management, utilization, and conservation of groundwater and surface water. This includes the NRDs' authorities (furthered under the Nebraska Groundwater Management and Protection Act Chapter 46 Article 7 regarding groundwater) to enter into contracts or agreements, budget and expend levied property taxes, own and operate property and equipment, and conduct investigations relative to the protection and management of groundwater.

12. Identify the probable environmental and ecological consequences that may result as the result of the project.

An improved understanding of the available groundwater resources of secondary bedrock aquifers will lead to a number of positive environmental and ecological outcomes. Understanding the age and water-quality characteristics of secondary aquifers will lead to improved management of existing systems which would prevent unsustainable water use and unnecessary development of new water systems. Proper management of existing bedrock aquifer water supplies will potentially eliminate the need for supplement water supplies from other existing rural water districts which may be further stressed during times of drought.

Section C.

NRC SCORING

In the NRC's scoring process, points will be given to each project in ranking the projects, with the total number of points determining the final project ranking list.

The following 15 criteria constitute the items for which points will be assigned. Point assignments will be 0, 2, 4, or 6 for items 1 through 8; and 0, 1, 2, or 3 for items 9 through 15. Two additional points will be awarded to projects which address issues determined by the NRC to be the result of a federal mandate.

Notes:

- The responses to one criterion will not be considered in the scoring of other criteria. Repeat references as needed to support documentation in each criterion as appropriate. The 15 categories are specified by statute and will be used to create scoring matrixes which will ultimately determine which projects receive funding.
- There is a total of 69 possible points, plus two bonus points. The potential number of points awarded for each criteria are noted in parenthesis. Once points are assigned, they will be added to determine a final score. The scores will determine ranking.
- The Commission recommends providing the requested information and the requests are not intended to limit the information an applicant may provide. An applicant should include additional information that is believed will assist the Commission in understanding a proposal so that it can be awarded the points to which it is entitled.

Complete any of the following (15) criteria which apply to your project. Your response will be reviewed and scored by the NRC. Place an N/A (not applicable) in any that do not apply, an N/A will automatically be placed in any response fields left blank.

1. Remediates or mitigates threats to drinking water;
 - Describe the specific threats to drinking water the project will address.
 - Identify whose drinking water, how many people are affected, how will project remediate or mitigate.
 - Provide a history of issues and tried solutions.
 - Provide detail regarding long range impacts if issues are not resolved.

The drinking water supplies in Eastern Nebraska are vulnerable to overuse and contamination. Secondary aquifers, such as the Dakota sandstone and Paleozoic limestones, are increasingly being viewed as potential drinking water supplies to

supplement current and future needs. Smaller towns within Eastern Nebraska have limited or diminishing access to primary aquifers, such as Clarkson and Howells in the Lower Elkhorn NRD (Lower Elkhorn NRD, Appendix 1).

Developing local secondary aquifers for smaller towns could alleviate water supply concerns for larger systems which are already stressed, particularly in times of drought. As an example, Papillion, Nebraska in the Papio-Missouri-River NRD (PMRNRD) has \$27.5 million planned in water system investment in next five years and is taking on the infrastructure of 27 Sanitary Improvement Districts. Lincoln, Omaha, and Fremont also have water system needs being considered for Water Sustainability Funds for similar sustainability reasons (NRDNet, 2015 - Appendix 1).

Understanding the secondary aquifers will help managers make informed decisions concerning potential options where to obtain local sustainable water supplies. Currently, very few studies exist focusing on the secondary aquifers across the state. Gosselin and others published a report focusing on the Dakota System. No studies have undertaken the secondary systems of Eastern Nebraska on a regional scale although they are already being used as a water supply by agricultural, domestic, commercial, industrial and municipal users (Appendix 2, Figure 1) throughout the area. The 2014 census estimates indicate 1.88 million people in NE, 1.3 million in ENWRA, 845,000 in Lancaster and Douglas Counties alone, leaving ~455,500 in rural areas (Nebraska Department of Economic Development, 2014 - Appendix 1). In addition, Lower Platte South (LPSNRD), Nemaha (NNRD), and Lower Platte North (LPNNRD) water managers indicated that there are known issues associated with the high salinity of the secondary Dakota and/or Paleozoic secondary aquifers causing reduced crop output and/or samples collected under permitting requirements in larger capacity wells with testing results near the salinity threshold levels set by the Districts. Some primary systems are also currently impacted by contaminants. Long range options are needed to mitigate potential future infrastructure costs, such as remediation and treatment of impacted supplies, and the possibility of extensive pipeline construction. As an example in western Dakota County in PMRNRD, at an NRD master plan public meeting, a groundwater nitrate problem was mentioned and it was suggested that it may be more economical to treat the water at the tap, rather than cleaning up the groundwater (Papio-Missouri River Natural Resources District, 2010 - Appendix 1). Strategic planning for obtaining water supplies is vital to provide to the residents of the region security in the livelihoods and community.

2. Meets the goals and objectives of an approved integrated management plan or ground water management plan;

- Identify the specific plan that is being referenced including date, who issued it and whether it is an IMP or GW management plan.
- Provide the history of work completed to achieve the goals of this plan.
- List which goals and objectives of the management plan the project provides benefits for and how the project provides those benefits.

This project specifically addresses the groundwater management concerns of each NRD within the region (Appendix 5). Each of the six NRDs state that groundwater quality/quantity will be monitored and managed for the use and safety of the residents (1985/1986 Groundwater Management Plans [GMPs] and subsequent updates to the NRDs' rules and regulations and GMPs to identify, manage and establish goals concerning groundwater quality [Nebraska Revised Statute Chapter 46, Article 6, Section 73.13]). The Lower Platte South and Papio-Missouri NRDs jointly adopted voluntary Integrated Management Plans (IMPs) with the DNR in the spring/summer of 2014 and have moved into the implementation phase (Appendix 5). The two plans include both water inventory and water supply management goals relating to sustainability. The first goal of the Lower Platte South plan regarding water inventory is to ensure the District has sufficient data to enable the achievement of a water supply that is in balance with current and future water demands. The first and second goals of the Papio-Missouri River plan includes developing/maintaining a water supply and use inventory based on the best available data and developing/implementing policies and practices that contribute to the protection of existing groundwater uses while allowing for future water development.

It is anticipated that the Lower Platte North and Lower Elkhorn IMPs will be completed in early 2016 and the goals will be similar in relation to the need for groundwater data for quality/quantity management and sustainability purposes. Further, these four centrally located ENWRA NRDs have also engaged with the other NRDs along the lower portion of the Platte River drainage in basin-wide planning effort to collaborate with the DNR. This effort (Lower Platte River Basin Coalition [LPRBC]) further demonstrates the history of working toward the goal of integrated management and reinforces each NRDs local IMP goals. The first action taken by the LPRBC was the development of a basin-wide water management plan. The purpose of the basin-wide water management plan is to collectively develop a plan that maintains a balance between current and future water supplies and demands (sustainability). The plan will provide guidance for developing water use policies and practices that contribute to the protection of existing surface and groundwater uses while allowing for future water development. Finally, it will assist in the development and maintenance of a water supply and use inventory based on the best available data and analysis (text about plan copied from <http://dnr.nebraska.gov/LPRBC> webpage). Each of these primary IMP and basin-wide goals are benefited by the project as the data being gathered (understandings on sustainability and quality measurements) is considered part of that "sufficient" and "best available" data analysis need mentioned. Please refer to Appendix 5 for a comprehensive summary of the history of NRD water management activities relating to data inventory and sustainability goals as of December 2012 for each of the ENWRA NRDs.

Regarding the remaining northern and southernmost ENWRA NRDs, the Lewis and Clark NRD (LCNRD) has recently expanded their groundwater monitoring well network to enhance their data inventory over the past several years and they are in the initial stages of the development of a voluntary IMP. The Nemaha NRD (NNRD) has a history with addressing groundwater quantity/quality concerns, as they updated GMP Rules and Regulations, regularly collects samples from over 100 wells throughout the District,

and have the following plan regarding private water supply wells (Nemaha Natural Resources District, 2011 - Appendix 1) which ties directly to the groundwater sampling/sustainability data gathering scope of this project: continue to promote and encourage routine private water well sampling and analysis, educate District residents on the health risks associated with groundwater contamination, on methods to treat the problem, and on actions to reduce or eliminate the reoccurrence, and look for opportunities to expand the water analysis programs. Like LCNRD and Nemaha, and as required in each of the ENWRA NRD GMPs and/or IMPs, the districts are each gathering groundwater quality monitoring data, however; much of the current monitoring focuses on the primary aquifers. Groundwater needs to be protected for agricultural, domestic, commercial/industrial, and municipal uses as more residents are turning to secondary aquifers. Having a poor understanding of the quality and sustainability does not allow for proper management of those aquifers. This project provides further monitoring data and reconnaissance (both quality and sustainability understandings) on the secondary aquifers thus benefiting/supporting the goals of the local and regional plans.

3. Contributes to water sustainability goals by increasing aquifer recharge, reducing aquifer depletion, or increasing streamflow;

List the following information that is applicable:

- The location, area and amount of recharge;
- The location, area and amount that aquifer depletion will be reduced;
- The reach, amount and timing of increased streamflow. Describe how the project will meet these objectives and what the source of the water is;
- Provide a detailed listing of cross basin benefits, if any.

This study focuses on the quality of the secondary aquifers, but will also collect data focused on age-dating the resource. This information will provide insight into the recharge of the secondary systems, such as the location of where recharge to groundwater might occur at higher rates and areas where sustainability could be of concern. This project includes the Lower Platte, Missouri Tributaries, and Nemaha basin areas.

4. Contributes to multiple water supply goals, including, but not limited to, flood control, agricultural use, municipal and industrial uses, recreational benefits, wildlife habitat, conservation of water resources, and preservation of water resources;
- List the goals the project provides benefits.
 - Describe how the project will provide these benefits
 - Provide a long range forecast of the expected benefits this project could have versus continuing on current path.

This project will help identify potential future water supplies for municipal, commercial/industrial, domestic, and agricultural use by describing the water quality characteristics and age distribution within secondary bedrock aquifers. In eastern Nebraska, secondary bedrock aquifers, such as the Dakota Aquifer, are increasingly being considered to supplement growing municipal, domestic, commercial/industrial, and agricultural water demands. An improved understanding of the three-dimensional extent and quality of the secondary bedrock aquifers is important in determining how increased development of the resource could impact the water quality. Furthermore, a better understanding of the age of the resources will show where recharge is occurring, and where anthropogenic compounds could be introduced into the system. Older groundwater ages generally indicate lower recharge rates and a potential sensitivity to additional development. An increased reliance on groundwater that is determined to be old (recharged pre-1950s) may lead to an unsustainable situation negatively impacting future municipal, domestic, commercial/industrial and agricultural water supplies. This study will provide additional data and insight that can be used by communities and water managers for the assessment and proper planning for future water development projects and potentially the ability to examine if their current management plans are adequate to meet future demands.

5. Maximizes the beneficial use of Nebraska's water resources for the benefit of the state's residents;

- Describe how the project will maximize the increased beneficial use of Nebraska's water resources.
- Describe the beneficial uses that will be reduced, if any.
- Describe how the project provides a beneficial impact to the state's residents.

This project will maximize beneficial use of Nebraska's water resources by describing the water quality characteristics and age distribution within secondary bedrock aquifers which can be used to supplement municipal, industrial/commercial, domestic, and agricultural needs. In some cases, secondary bedrock aquifers are the primary water source for municipal, industrial, domestic, commercial/industrial and agricultural needs and little information exists that describe water quality conditions. Understanding how the water quality characteristics and ages of water vary (both laterally and vertically) within the aquifer will provide water managers information to improve current management plans. Older groundwater ages generally indicate lower recharge rates and a potential sensitivity to additional development. An increased reliance on groundwater that is determined to be old (recharged pre-1950s) may lead to an unsustainable situation negatively impacting future municipal, domestic, and agricultural water supplies. This study will provide additional data and insight that can be used by communities and water managers for the assessment and proper planning for future water development projects and potentially the ability to examine if their current management plans are adequate to meet future demands.

6. Is cost-effective;

- List the estimated construction costs, O/M costs, land and water acquisition costs, alternative options, value of benefits gained.
- Compare these costs to other methods of achieving the same benefits.
- List the costs of the project.
- Describe how it is a cost effective project or alternative.

The value of benefits gained from the project out weight the costs of conducting this initial reconnaissance project. There are no construction, O/M, or land/water acquisition costs. The new information (the alternative is collecting no information) can be used in a targeted manner for years following. Targeted informed management could help prevent expensive well installations that may yield non-sustainable or poor quality water supplies. Regarding municipal well costs (17 installed in ENWRA in last 2 years): they could be anywhere from \$200,000 to \$500,000 if you include the pump, wellhouse, controls and electrical depending on the end application (see Section B #3 for reference). The domestic well installations (587 installed in ENWRA in last two years), typically range from \$18 to \$25 per foot (see Section B #3 for reference) for wells 50 to 350 feet deep (\$900-\$8,750). Irrigation wells (432 installed in ENWRA the last two years) are in the middle range with installations expected to be \$40,000 to \$80,000 in the secondary aquifers for eastern Nebraska (see Section B #3 for reference).

Activity	Cost Year 1	Cost Year 2*	Cost TOTAL	Benefits (potential cost savings of siting 3 well types in unsuitable aquifers)
WSF Grant funding	\$96,300	0	\$96,300	Municipal well cost: \$200,000-\$500,000 Irrigation well cost: \$40,000-\$80,000 Domestic well cost: \$900-\$8,750
USGS	\$27,500	\$22,000	\$49,500	
ENWRA	\$34,200	\$30,000	\$64,200	
TOTALS			\$210,000	\$240,900-\$588,750

*Funding is only sought for one year through the Water Sustainability Fund. Funding will be carried over into year 2 to complete proposed activities.

7. Helps the state meet its obligations under interstate compacts, decrees, or other state contracts or agreements or federal law;

- Identify the interstate compact, decree, state contract or agreement or federal law.
- Describe how the project will help the state meet its obligations under compacts, decrees, state contracts or agreements or federal law.
- Describe current deficiencies and document how the project will reduce deficiencies.

The secondary aquifers are being looked at for domestic and municipal drinking water uses. The responsibility for ensuring safe drinking water is divided among the U.S. EPA, states, tribes, water systems, and the public (refer to Section C question #16 regarding applicable federal mandate discussions and the Safe Drinking Water Act). Additionally, we interpret the Nebraska Title 118 policy as applicable to “interstate compacts,

decrees, or other state contracts or agreements or federal law.” As stated in Nebraska Title 118-Ground Water Quality Standards and Use Classifications, “It is the public policy of the State of Nebraska to protect and improve the quality of ground water for human consumption; agriculture, industry and other productive, beneficial uses...”. Nebraska Title 118 also defines the maximum contaminant levels for specific constituents in drinking water supplies. Additionally, many of the NRDs are monitoring nitrates and other contaminants within their districts to determine the impact of agricultural development in their water supplies, as these contaminants can adversely affect individuals who consume it. NRDs have the authority to regulate certain management areas where contaminant levels are above a certain threshold to protect the consumers of the resource. Each of the ENWRA NRDs have groundwater protection plans in place through their Groundwater Management Plans (Appendix 5).

8. Reduces threats to property damage or protects critical infrastructure that consists of the physical assets, systems, and networks vital to the state or the United States such that their incapacitation would have a debilitating effect on public security or public health and safety;
 - Identify the property that the project is intended to reduce threats to.
 - Describe and quantify reductions in threats to critical infrastructure provided by the project and how the infrastructure is vital to Nebraska or the United States.
 - Identify the potential value of cost savings resulting from completion of the project.
 - Describe the benefits for public security, public health and safety.

This project is designed to better understand municipal water supplies which is part of a community's water supply infrastructure. Unsustainable use of rural or urban water supplies would threaten community health and safety. This study will also address the vulnerability of existing water supplies of the secondary aquifers through overuse and contamination. The potential to avoid remediation costs, tying into other systems, or improper siting of new wells or municipal systems are all possible cost savings that could result from the project (Section C #6 text and tables). This study will provide a proactive approach to developing sustainable long-term supplies of drinking water.

9. Improves water quality;
 - Describe what quality issue(s) is/are to be improved.
 - Describe and quantify how the project improves water quality, what is the target area, what is the population or acreage receiving benefits, what is the usage of the water: residential, industrial, agriculture or recreational.
 - Describe other possible solutions to remedy this issue.
 - Describe the history of the water quality issue including previous attempts to remedy the problem and the results obtained.

This project may improve water quality by providing reconnaissance on the quality of the secondary aquifers for consumptive uses and sustainability for the 1.3 million people in eastern Nebraska (Nebraska Department of Economic Development, 2014 - Appendix 1). Project data and reporting could lead to informed management and development of the resource and potentially provide an alternate option for domestic and municipal uses if local primary aquifers are impaired. Existing studies and reports have focused on the source and mineralogical composition of the water and not consumptive use and sustainability. One recent study focused on the quality of the Dakota aquifer in Nebraska (Gosselin and others, 2001 - Appendix 1), but the extent of the study area in this proposed project is larger than the study area in the published report and includes both the Dakota and other secondary aquifers. There are no other studies focused on determining the quality of the secondary aquifers. This proposal is the first step in determining the quality of these aquifers and determining if the resource is suitable for domestic, municipal and agricultural uses, and the sustainability of the resource to support these as well as potential commercial/industrial uses.

10. Has utilized all available funding resources of the local jurisdiction to support the program, project, or activity;

- Identify the local jurisdiction that supports the project.
- List current property tax levy, valuations, or other sources of revenue for the sponsoring entity.
- List other funding sources for the project.

The 6 NRDs that are the part of ENWRA have allocated funds specifically for the study of the hydrogeology and groundwater resources and are planning to use those for this study (letters of support from each NRD are included in Appendix 4). ENWRA's Long Range Plan funding commitments are summarized in Table 1 of Appendix 3 which also includes a specific item (item 2B) reflecting the need for this project. ENWRA NRD tax levy information is summarized on Table 2 of Appendix 3 with demographic and ENWRA dues breakdown information. The USGS is providing \$49,500 in cooperative water dollar funds to put towards this work (see Appendix 4 for a letter of support). Other funding sources have not been approached or envisioned for the project.

11. Has a local jurisdiction with plans in place that support sustainable water use;

- List the local jurisdiction and identify specific plans being referenced that are in place to support sustainable water use.
- Provide the history of work completed to achieve the goals of these plans.
- List which goals and objectives this project will provide benefits for and how this project supports or contributes to those plans.
- Describe and quantify how the project supports sustainable water use, what is the target area, what is the population or acreage receiving benefits, what is the usage of the water: residential, industrial, agriculture or recreational.
- List all stakeholders involved in project.

- Identify who benefits from this project.

This project specifically addresses the sustainable water use concerns of each local NRD through reconnaissance on both quality and age/vulnerability understandings for the secondary aquifers increasingly being used in the region. Each of the six NRDs state that groundwater will be managed to protect the current and future water supplies and demands (see Section C #2 for detailed description of plans referenced, history of work completed on sustainable water use and which plan goals and objectives the project provides benefits for/supports).

The LCNRD outlined the Niobrara Chalk Bedrock Reservoir (Appendix 2, Figure 2) as a fractured bedrock aquifer where potential for high rates of in-season decline is likely (2014 update to their GMP, Appendix 5). In addition, the Nemaha has fractured limestone bedrock aquifers which are limited in their ability to transmit water as a supply but the sustainability of that small amount is important to many smaller volume, domestic users (Appendix 2, Figure 1).

Nebraska Title 264 Chapter 1, 002.24 Water Sustainability: “Water Sustainability” shall mean water use is sustainable when current use promotes healthy watersheds, improves water quality, and protects the ability of future generations to meet their needs. Sustainability goes hand in hand with the data meaning you can’t improve on/secure what you have not measured. The population or land area receiving benefits from the data reconnaissance effort in this project would be approximately 1.3 million people in and around 186 communities/27 counties covering approximately 8.1 million acres or the eastern third of the state (Nebraska Department of Economic Development, 2014 - Appendix 1 & Table 2 – Appendix 3) because in ENWRA’s experience recon is an essential initial step to gathering that detailed picture which is the end game of hydrogeological assessment/this project’s track. This detailed picture would be the extent (where accessible for use), volume (acre-feet in storage), quality (variety of parameters of concern) and sustainability of the usable secondary aquifer resource for the people (residential, industrial/commercial, agriculture or recreational) as more residents are turning to these aquifers. The stakeholders are the individual owners of domestic and agricultural/commercial water supply wells and municipal and local NRD water managers. This project benefits all current stakeholders and future generations.

12. Addresses a statewide problem or issue;

- List the issues or problems addressed by the project and why they should be considered statewide.
- Describe how the project will address each issue and/or problem.
- Describe the total number of people and/or total number of acres that would receive benefits.
- Identify the benefit, to the state, this project would provide.

A primary objective for the project sponsors’ groundwater quality and quantity management (statutory obligations/histories/plans described in detail in Section C

question #2) is the need for improvements to the groundwater data inventory, especially related to sustainability which this project addresses. This need for groundwater data is in common with all 23 NRDs statewide as they all have groundwater management plans/regulations in-place and are in various stages of integrated water management and building their local water data inventories. In addition, the specific local quality issues (primarily nitrates) that exist within the primary aquifers within the project region are also common statewide issues (Appendix 2, Figure 3) for municipalities and rural users (domestic , commercial/industrial, and agricultural). These quality issues are causing water users to turn to the secondary aquifers because those aquifers are generally less likely to have nitrate impacts.

An example local nitrate issue is the Bazile Groundwater Management Area (GWMA), which includes land in the Lewis and Clark, Lower Elkhorn, and two other NRDs to the west that are organized in a combined effort that has allowed for the following: 1) implementation of several rules and regulations to minimize the impact of farming practices on water quality (more than 50% of irrigation wells monitored for water quality contained over 10 ppm nitrates in October 2004), 2) biennial quality monitoring of irrigation wells, and 3) provision options to improve practices over time to turn around the trend of increasing nitrate levels.

The Nemaha NRD also has a history with addressing groundwater nitrate concerns in the primary aquifer, as they updated the Groundwater Management Plan Rules and Regulations In August 1999 placing the entire District into a Phase I Groundwater Management Area due to elevated nitrates. However, secondary aquifers also have some naturally occurring quality/sustainability issues (LPNNRD, LPSNRD, and NNRD examples in Section C #1 and LCNRD example in Section C #11) but are already in use in each of the ENWRA NRDs (Appendix 2, Figure 1) so this study will benefit that cart ahead of the horse issue, get the data then make the management decisions.

This study although it has a regional focus, could be used as a concept of study to learn more about secondary aquifers in other parts of the state. If eventually other parts of the state did use this study concept, that could translate to the entire state receiving benefit (1.8 million people and 49.2 million acres – Appendix 2, Figure 4) not just the region. Groundwater needs to be protected for agricultural, domestic and municipal uses as more water users are turning to secondary aquifers.

13. Contributes to the state's ability to leverage state dollars with local or federal government partners or other partners to maximize the use of its resources;

- List other funding sources or other partners, and the amount each will contribute, in a funding matrix.
- Describe how each source of funding is made available if the project is funded.
- Provide a copy or evidence of each commitment, for each separate source, of match dollars and funding partners.
- Describe how you will proceed if other funding sources do not come through.

Activity	Cost Year 1	Cost Year 2*	Cost TOTAL
WSF Grant funding (state)	96,300	0	96,300
USGS (federal)	27,500	22,000	49,500
ENWRA (local)	34,200	30,000	64,200
TOTALS			210,000

*Funding is only sought for one year through the Water Sustainability Fund. Funding will be carried over into year 2 to complete proposed activities.

ENWRA has allocated \$64,200 of its funds towards this project. The US Geological Survey has Cooperative Water Program fund dollars available for this project. If funded, the project will have state, local and federal funding sources contributing to (and partnering on) the reconnaissance effort resulting in mutual and individual benefit for each. Please see Appendix 4 for letters of support pledging the associated funding amounts (also Table 2 of Appendix 3 lists ENWRA dues breakdown and tax levy information for each NRD and Table 3 of Appendix 3 depicts the ENWRA funds in reserve as of FY16). The project will not be initiated at this time if grant match funding is not obtained.

14. Contributes to watershed health and function;

- Describe how the project will contribute to watershed health and function in detail and list all of the watersheds affected.

Sustainable groundwater is a significant component of watershed system health and function. The work proposed in this project will help determine the quality and connectivity of the secondary aquifers to the regional watershed (six eastern Nebraska NRDs including the Lower Platte, Missouri Tributaries, and Nemaha basin areas). The increased understanding of the highly variable, diverse aquifers will allow for more informed management which in turn protects the areas with the greatest sustainability and quality concerns and helps maintain the overall watershed's function.

15. Uses objectives described in the annual report and plan of work for the state water planning and review process issued by the department.

- Identify the date of the Annual Report utilized.
- List any and all objectives of the Annual Report intended to be met by the project
- Explain how the project meets each objective.

The DNR supported the ENWRA group in mapping and assessing the groundwater resources in Eastern Nebraska using airborne geophysical methods as stated in the DNR's 2014 annual report. This project uses the data obtained from that DNR/ENWRA effort (resulting GIS bedrock surfaces) to target registered wells (also a DNR provided

dataset) screened in the secondary aquifers for sampling. The DNR annual report to the legislature dated September 2015 also outlines interagency coordination, integrated management, and prioritization of data collection and analysis capabilities to support state and local planning efforts which this both this project and ENWRA demonstrate through their partner teaming and hydrogeologic reconnaissance efforts.

16. Federal Mandate Bonus. If you believe that your project is designed to meet the requirements of a federal mandate which furthers the goals of the WSF, then:

- Describe the federal mandate.
- Provide documentary evidence of the federal mandate.
- Describe how the project meets the requirements of the federal mandate.
- Describe the relationship between the federal mandate and how the project furthers the goals of water sustainability.

The Safe Drinking Water Act of 1947 (Pub.L.93-523 88 Stat. 1660 42 U.S.C. §300) discusses the protection of groundwater sources of drinking water in Part C of the law. Part B discusses Public Water Systems, the definition of a public system, contaminants identified as threats to public health and the acceptable levels of these contaminants in public systems. Part C discusses the designation of a sole source aquifer (section 1427) and the establishment of wellhead protection areas (section 1428). No widespread data has been collected within the ENWRA area which focuses on contaminants that pose a risk to public health. The purpose of this study to determine the quality of the water and whether the water will be suitable for human consumption. Municipal supplies may utilize this resource, and therefore the Safe Drinking Water Act would apply to these systems. Before the municipalities decide to utilize the resource, they need to know if the water quality is suitable for human consumption and if the resource is sustainable for long term use. This study will provide answers to those questions.

Section D.

PROJECT DESCRIPTION

1. Overview

In 1,000 characters or less, provide a brief description of your project including the nature and purpose of the project and objectives of the project.

In eastern Nebraska, bedrock aquifers are increasingly being considered to supplement growing municipal, domestic, commercial/industrial and agricultural water demands. The Eastern Nebraska Water Resources Assessment (ENWRA) is a project sponsored by six Natural Resources Districts to develop a geologic framework for water resources management. Airborne geophysical surveys have mapped the thickness and extent of aquifers over much of eastern Nebraska. Currently little is known about the age and quality of water in the Dakota Aquifer and other bedrock aquifers, which is needed to determine the sustainability of the resource. Older groundwater ages generally indicate lower recharge rates and a potential sensitivity to additional development. An increased reliance on groundwater that is determined to be old (recharged pre-1950s) may lead to an unsustainable situation negatively impacting future water supplies. This study will sample 20 wells for basic water chemistry, nutrients, stable isotopes and selected age tracers. Following sample collection, analysis, and data interpretation, an interpretive report will be produced summarizing the effort.

2. Project Tasks and Timeline

Identify what activities will be conducted by the project. For multiyear projects please list what activities are to be completed each year.

1.) Select well locations and secure permission to sample in year one, 2.) Sample and field work preparation including QA plans in year one, 3.) Collect samples and submit for analysis in year one, 4.) Compile historical data in year one and two, 5.) Analyze current and historical data in year one and two, 6.) Interpretation and report writing in year one and two, 7.) Disseminate and present findings to stakeholders (year two and ongoing in-kind).

3. Partnerships

Identify the roles and responsibilities of agencies and groups involved in the proposed project regardless of whether each is an additional funding source. List any other sources of funding that have been approached for project support and that have officially turned you down. Attach the rejection letter.

ENWRA NRDs – well location and permission local logistics; ENWRA coordinator Katie Cameron - fund administration and project coordination; and USGS everything relating to the sampling and reporting scope. We have not approached additional funding sources for this work. The local board of directors for LPSNRD, the ENWRA NRD lead and financial handling agency, has approved submittal of this application and allocation of the necessary funds on behalf of ENWRA per their local governmental process. Please refer to Appendix 3, Table 3 and Appendix 4 LPSNRD letter of support for reference.

4. Other Sources of Funding

Identify the costs of the entire project, what costs each other source of funding will be applied to, and whether each of these other sources of funding is confirmed. If not, please identify those entities and list the date when confirmation is expected. Explain how you will implement the project if these sources are not obtained.

Table of budget

Activity	Cost Year 1	Cost Year 2*	Cost TOTAL
WSF Grant funding (sample collection and analysis, and reporting)	96,300	0	96,300
USGS (sample collection and analysis)	27,500	22,000	49,500
ENWRA (site selection, permission to sample, and reporting)	34,200	30,000	64,200
TOTALS			210,000

*Funding is only sought for one year through the Water Sustainability Fund. Funding will be carried over into year 2 to complete proposed activities.

ENWRA has allocated \$64,200 of its funds towards this project. The US Geological Survey has Cooperative Water Program fund dollars available for this project. Please see Appendix 4 for letters of support pledging the associated funding amounts (Table 2 of Appendix 3 lists ENWRA dues breakdown and tax levy information for each NRD and Table 3 of Appendix 3 depicts FY16 ENWRA banked fund amounts for reference). The project will not be initiated at this time if grant match funding is not obtained.

5. Support/Opposition

Discuss both support and opposition to the project, including the group or interest each represents.

Reference letters of support from the project sponsors are included in Appendix 4. ENWRA's long range plan includes the project scope (Appendix 3, Table 1 Item 2B) and supports understanding the resources within the area (Appendix 3, Table 1 items 3, 4, and 6 are also tie into this project). There is no known/anticipated opposition to the project.